UCRL-JC-125196 Abs

3-D Field-Scale Remediation Optimization at Lawrence Livermore National Laboratory

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Optimal groundwater remediation design involves significant computational burden. The burden increases as the predictive models become more complex and there is greater interest in understanding the impact of uncertainty on the predictive models. Thus, methods which widen the computational bottleneck are vital to the continued application of these methods at a field-scale.

We have been working with issues of optimal remediation design at Lawrence Livermore National Laboratory (LLNL) for many years. Thus far we have been building on a 2-D finite difference/finite element transport code, SUTRA, and using trained artificial neural networks (ANNs) to approximate the outcome of the flow and transport code (GFTC). The search itself has generally been directed by the genetic algorithm (GA). This approach has advantages of 1) 106 increase in speed of remediation pattern assessment during the searches and sensitivity analyses for the 2-D LLNL work, 2) freedom from sequential runs of the flow and transport code (enables workstation farming), and 3) recycling of the knowledge base (i.e. runs of the GFTC necessary to train the ANNs). The remediation effort at LLNL continues to mature and the field characterization now supports 3-D modeling. In an effort to address evolving management issues, we have begun an multidisicplinary effort based on a 3-D stochastic, high performance simulator, ParFlow. Some issues currently being examined are bracketing of transport parameter uncertainty and gauging tradeoffs between strategies targeting the plume edge or source areas.

Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract W-7405-ENG-48.